

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
6 September 2002 (06.09.2002)

PCT

(10) International Publication Number
WO 02/069660 A1

(51) International Patent Classification⁷: **H04Q 7/38**

(21) International Application Number: **PCT/EP02/01936**

(22) International Filing Date: **23 February 2002 (23.02.2002)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
01104631.5 **23 February 2001 (23.02.2001)** **EP**

(71) Applicant (for all designated States except US): **TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)**
[SE/SE]; S-126 25 Stockholm (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KEUTMANN, Heinz-Peter** [DE/DE]; Schubertweg 3, 52249 Eschweiler (DE). **KOBRIKER, Peter** [DE/DE]; Sandweg 43, 52072 Aachen (DE).

(74) Agent: **TONSCHEIDT, Andreas**; Ericsson Eurolab Deutschland GmbH, Ericsson Allee 1, 52134 Herzogenrath (DE).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

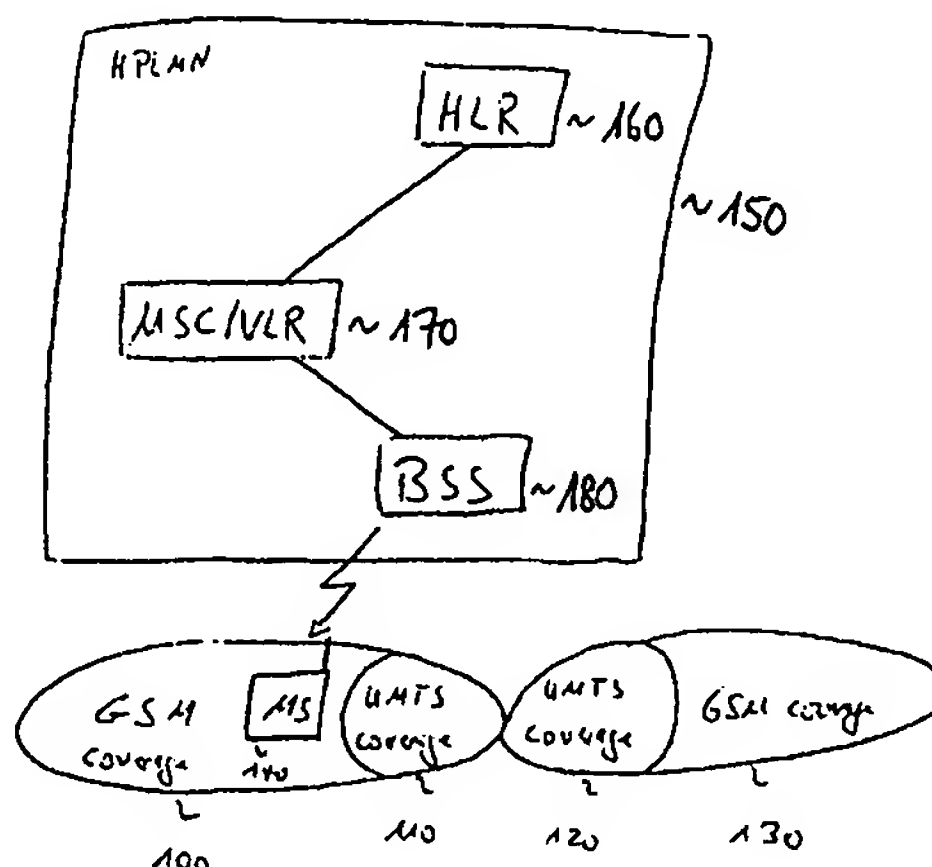
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG,

[Continued on next page]

(54) Title: **LOCATION UPDATE PROCEDURE WHEN ROAMING FROM A FIRST COMMUNICATIONS SERVICE DOMAIN TO A SECOND COMMUNICATIONS SERVICE DOMAIN**



(57) Abstract: The invention relates to a location update procedure in a mobile communications system (150) having at least one first communications service domain (100) and at least one second communications service domain (110). The mobile subscriber (140) is allowed to register in said first communications service domain. A location update request is received at a network element (170) of the communications system, and a subscription restriction information is received at this network element, said subscription restriction information indicating, whether a roaming restriction for a roaming into the second communications service domain applies for the mobile subscriber. The subscription restriction information is evaluated, and the location update procedure is performed depending on the evaluation. The invention relates further to a corresponding network element (170), home subscriber data register (160), user equipment (140) and computer program.

WO 02/069660 A1



MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— with international search report



LOCATION UPDATE PROCEDURE WHEN ROAMING FROM A FIRST COMMUNICATIONS SERVICE DOMAIN TO A SECOND COMMUNICATIONS SERVICE DOMAIN.

The invention addresses the field of mobile communications. It relates to a method, device and computer program for performing a location update procedure for a mobile subscriber. It relates in particular to a roaming of a mobile subscriber from a 2nd generation system domain like a Global System for Mobile Communication GSM domain to a 3rd generation system domain like a Universal Mobile Telecommunication System UMTS domain, or vice versa.

10 **Background of the invention**

In mobile communications systems, a location update procedure is performed to allow a roaming of a subscriber from one to another service domain. E.g., if a mobile subscriber, who is registered in a service domain of his Home Public Land Mobile Network HPLMN operator, leaves his home country and moves to a service domain operated by a Visited Public Land Mobile Network VPLMN operator, the location update procedure is performed to allow for the international roaming. Details about service accessibility can be found, e.g., in 3G TS 22.011 v.3.3.0, 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Service accessibility (Release 1999).

20

The term 'roaming' describes as well a scenario, wherein the mobile subscriber has currently not accessed his HPLMN domain, e.g. because the terminal is at present switched off, but accesses while being located in a VPLMN domain the VPLMN domain by switching his terminal on.

25

For UMTS, it is planned to use GSM Subscriber Identity Modules SIMs in a UMTS mobile terminal to get access to service. However, the current standards for roaming in UMTS and GSM as well as the legal requirements set by individual national countries, differ with respect to roaming for the subscriber. UMTS subscribers will be entitled to national roaming, as it is foreseen that the UMTS networks initially consist of small islands only. To provide more frequent access to service, the

30

subscriber shall have the possibility to register to networks on a national basis in addition to international roaming.

GSM subscribers are usually not entitled to national roaming. Nevertheless, the
5 GSM subscriber using a dual mode, e.g. GSM-UMTS, mobile terminal shall be able to access both GSM and UMTS systems in his home country as well as abroad.

Currently, it is not possible to allow for a differentiated accessing of dedicated service domains according to the outlined roaming rules, as there is no means to
10 distinguish GSM subscribers from UMTS subscribers. The reason is that for the 3GPP Release 99 and beyond, both GSM and UMTS apply the same security mechanisms as stated in 3G TS 33.102, v. 3.6.0, 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Security Architecture, clause 6.8.1.1.

15

Problems occur for roaming cases involving a Home Public Land Mobile Network HPLMN operator and a Visited Public Land Mobile Network VPLMN operator if both of them are running GSM and UMTS networks in the same country and are using the same Mobile Network Codes MNCs for their networks. Such a scenario is
20 likely in particular in the early days of UMTS introduction when operators run their UMTS networks from an administration point of view as extensions of their existing GSM networks.

If a GSM subscriber being served by his HPLMN operator's UMTS network moves,
25 he can get out of coverage of his HPLMN operator's UMTS network but in coverage of another UMTS operator's network. According to national roaming agreements for UMTS he is granted service by the visited UMTS network. If getting out of coverage of the visited UMTS network, he is served by the same network operator's GSM network. Although there might be no roaming agreement for GSM
30 existing between the GSM networks, the GSM subscriber cannot be prevented from roaming to the foreign GSM network.

Summary of the invention

It is an object of the invention to provide a method, device and computer program for a differentiation of access entitlements of a mobile subscriber to dedicated
5 service domains of a mobile communications system.

This is solved by the teaching of the independent claims.

A mobile communications system has at least one first communications service
10 domain, e.g. a GSM domain, and at least one second communications service domain, e.g. a UMTS domain. A mobile subscriber is allowed to access said first communications service domain, which is e.g. a service domain of his HPLMN operator. A location update request is received at a network element, preferably a Mobile Switching Centre MSC or a Serving GPRS Support Node SGSN, of the
15 communications system. A skilled person understands easily that the network element can be any further network node or part of any further network node of the communications system. E.g., the inventive function can be performed as well in an HLR.

20 For performing a location update procedure for the mobile subscriber, a subscription restriction information is received at the network element. The subscription restriction information indicates, whether an access restriction for accessing the second communications service domain applies for the mobile subscriber. The subscription restriction information is evaluated at the network element, and the
25 location update procedure is performed depending on the evaluation.

Advantageously, the provision of a subscription restriction information allows for a differentiated treatment of mobile subscribers using dual mode, e.g. GSM/UMTS, terminals with respect to roaming. Operators can design their UMTS networks
30 according to island concepts for areas having a high population in an efficient way, while simultaneously providing in general a broad service coverage to their

customers via GSM. Differentiated roaming agreements can be set with other operators. Individual roaming requirements given by national laws can easily be fulfilled. Furthermore, the mobile subscribers can benefit from dedicated roaming possibilities and access entitlements in terms of optimised service coverage.

5

Operators running both GSM and UMTS networks will be able to provide to their customers services allowing to distinguish between GSM, UMTS, as well as inter-system roaming services.

10 According to the invention, a home subscriber data register, e.g. a Home Location Register HLR is adapted to store a subscription restriction information assigned to stored data of a mobile subscriber. The subscription restriction information indicates at least one access restriction that applies to the mobile subscriber for accessing a communications service domain of a mobile communications system.

15

Advantageously, the HPLMN operator keeps by storing the subscription restriction information in his HLR control of the restrictions. Furthermore, easy administration and modification of the subscriber restrictions are possible. Advantageously, the operator can use the same Mobile Network Code MNC for both his GSM and

20 UMTS portion of his PLMN, e.g. by simply storing an indicator in the network administration data belonging to the respective service areas giving the corresponding access type, e.g. GSM or UMTS.

A user equipment of a mobile subscriber is adapted to store a subscription

25 restriction information that indicates at least one access restriction that applies to the mobile subscriber for accessing a communications service domain of a mobile communications system. The user equipment can be any terminal like a GSM-, GPRS- or UMTS-phone, -laptop or -adapter. The user equipment can comprise a Subscriber Identity Module SIM card that stores the subscription restriction

30 information.

Advantageously, the storing of the subscription restriction information in the user equipment can reduce the administrative effort of the operator because a central database administering the restriction information is not needed. Furthermore, the subscription restriction information can easily be displayed to the mobile subscriber.

5

It should be noted that the signalling of the subscription restriction information can be performed by a network element, e.g. HLR, by a user equipment, or by both of them. Advantageously, an operator can decide for the latter case in particular if there are differences in the restriction information, which one of the signalling
10 sources gets priority. Furthermore, the restriction information of the two signalling sources can be evaluated in a complementary way.

Furthermore, the invention can be realised by a computer program, which is loadable into the internal memory of a digital processing unit, comprising software
15 code portions adapted to control the steps of the described methods, when the computer program is executed on the digital processing unit. Therefore, servers that are by means of the computer program adapted to perform the inventive method can easily represent network elements according to the present invention.

20 Preferred embodiments of the invention are described in the dependent claims.

A location update is performed if the evaluation of the subscription restriction information indicates that an accessing of the second communications service domain is allowed for the mobile subscriber.

25

A location update request is rejected if the subscription restriction information evaluation indicates that an accessing of the second communications service domain is not allowed for the mobile subscriber.

30 In a preferred embodiment, an error information is sent in response to the location update request if the request is rejected, said error information indicating an access

restriction as a reason for the rejection. Therefore, redundant re-tries of a location update request that has already been rejected can be avoided.

In a further preferred embodiment, the subscription restriction information is received within the location update request sent from a user equipment of the mobile subscriber. Advantageously, the receiving network node can evaluate, whether a corresponding accessing and/ or roaming of the mobile subscriber is allowed, without requesting said information from a further network node, e.g. from an HLR. Therefore, signalling traffic can be avoided.

10

In another preferred embodiment, the subscriber data information is requested from a home subscriber data register, e.g. an HLR, and the subscription restriction information is received within subscriber data information sent from the home subscriber data register. Advantageously, there is no need to store the subscription restriction information in the user equipment. Instead, the information is under the control of the HPLMN operator. Advantageously, signalling traffic is minimised by using the transmission of subscriber data information, e.g. by a corresponding Mobile Application Part MAP message, which is performed for the purpose of location update, also for the transmission of the subscription restriction information.

20

In a further embodiment, the subscriber restriction information comprises an access network type restriction information indicating an access network type restriction. Access network types are e.g. GSM, GPRS, UMTS or Wireless LAN.

25

In another embodiment, the subscription restriction information comprises a frequency band restriction information indicating a frequency band restriction.

Depending on the used radio access technique, mobile communications systems can use different frequency bands, also called frequency areas, to provide radio access.

Preferably, frequency bands are symbolized by a significant frequency, e.g. 800

30

MHz, 1800 MHz, 1900 MHz (all GSM), and 2400 MHz (UMTS).

In a further embodiment, the subscription restriction information comprises a Public Land Mobile Network PLMN type restriction information indicating a PLMN restriction. PLMN types are e.g. a HPLMN or a VPLMN. Alternatively, individual operator identifiers can be PLMN types as well.

5

In another embodiment, the home subscriber data register HLR is adapted to send on request a subscriber data information comprising a subscription restriction information that applies to the mobile subscriber. Therefore, a network element like a MSC or SGSN can retrieve - based upon a location update request received from a user equipment – the corresponding subscription restriction information in order to evaluate whether the subscriber is entitled to the requested communications service domain access.

In a further embodiment, the user equipment is adapted to send a location update request comprising the subscription restriction information, if the user equipment determines a change of its location area.

In another preferred embodiment the computer program is stored on a computer readable medium like a CD-ROM, a floppy disc, optical disc or hard disk. Therefore, a good physical portability of the control software is provided, i.e. upgrades of network elements represented by servers can be performed in an easy way.

Brief description of the figures

25 The figures show:

- Fig. 1 a simplified HPLMN and its served communications service domains,
- Fig. 2 a simplified HPLMN and VPLMN and a hybrid coverage communications service domain,
- 30 Fig. 3 a message flow for a HPLMN-controlled location update procedure with allowed UMTS access,

- Fig. 4 a further message flow for a HPLMN-controlled location update procedure for a GSM subscriber accessing a GSM network,
- Fig. 5 a structure of a 'insert subscriber data' message,
- Fig. 6 a a 1 bit embodiment for a subscription restriction parameter SRP,
- 5 Fig. 6 b a 2 bit embodiment for a SRP,
- Fig. 6 c a 4 bit embodiment for a SRP,
- Fig. 6 d a 6 bit embodiment for a SRP for multiband operation restriction
- Fig. 7 a further message flow for a HPLMN-controlled location update procedure for a GSM subscriber requesting access to a UMTS network, and
- 10 Fig. 8 a further message flow for a user-equipment controlled location update procedure for UMTS access with UMTS SIM indication.

Detailed description

15 A subscription parameter can be present in both the subscriber data stored in the HLR as well as on the SIM or in the user equipment itself. It can be used for two different types of roaming services allowing network operators (HPLMN and VPLMN) to allow and reject access to their network. The serving MSC is able to determine the access type the subscriber used.

20

One type of roaming services refers to roaming restriction due to subscription restriction via the HPLMN. Preferably, a currently unused parameter "Subscription restriction" as described in 3G TS 23.008 v. 3.5.0: 3rd Generation Partnership Project; Technical Specification Group Core Network; Organisation of subscriber data (Release 99), clause 2.4.10, is enhanced to cover possible scenarios. According to the invention, this parameter is downloaded to the visited MSC/VLR (VMSC) at location update. The VMSC grants or rejects access to a roaming subscriber depending on the settings of this parameter and the type of access the subscriber uses. Additionally, if access is denied, a specific error, i.e. error code, can be

25

30 generated and sent to the mobile station of the subscriber, e.g. to trigger network reselection.

This approach can also be used to allow/reject GSM/UMTS roaming in the HPLMN.

5 Another type of roaming services refers to roaming restriction due to subscription restriction (VPLMN). The UMTS SIM (USIM) contains a parameter giving the same range as the one described in the above paragraph. Preferably, the parameter is introduced as a capability and configuration parameter (3G TS 21.111, v. 3.3.0: 3rd
10 Generation Partnership Project; Technical Specification Group Terminals; USIM and IC Card Requirements, release 1999, clause 10.1). At location update, the VMSC checks the value of this parameter and grants/rejects access to a roaming subscriber depending on the settings of this parameter and the type of access the subscriber uses. If access is denied, a specific error can be generated and sent to the mobile station of the subscriber, e.g. to trigger network reselection.

15

In the following, the invention and its embodiments are described with reference to the figures.

Fig. 1 shows simplified a mobile communications system 150 comprising a Home
20 Location Register (HLR) 160 storing subscriber data of mobile subscribers, a Mobile Switching Centre / Visitor Location Register (MSC/VLR) 170 performing, e.g., switching tasks and by means of location updates registrations of mobile subscribers in communications service domains, and a Base Station System (BSS) 180 providing radio access to the mobile communications system 150. The mobile
25 communications system 150 represents a Home Public Land Mobile Network (HPLMN) of an operator. The HLR 160 is connected to the MSC/VLR 170. The MSC/VLR 170 is connected to the BSS 180.

In alternative embodiments, the MSC/VLR can be a pooled network node. The VLR
30 can be implemented by a separate network node. The BSS can be represented by a

Radio Network Controller RNC. The MSC, or respectively the MSC/VLR can be a Serving GPRS Support Node SGSN.

The mobile communications system provides communications services in different coverage areas, i.e. communications service domains. There are communications service domains providing GSM coverage 100, 130. Other communications service domains provide UMTS coverage 110, 120. A user equipment (MS) 140, e.g. a mobile terminal, that is registered in such a domain communicates via the BSS 180 with the communications system 150.

10

The invention applies to both circuit-switched and / or packet switched domains. Furthermore, a skilled person can easily derive further appropriate communications service domain types, i.e. access network types, than GSM or UMTS, e.g. a Wireless Local Area Network Type (Wireless LAN) or a Bluetooth TM network type.

15

If a mobile subscriber using the MS 140 moves from one communications service domain to another, a location update procedure is performed in order to register the MS 140 for the purpose of service provisioning in the newly entered communications service domain. Technical compatibility of the MS 140 provided, it depends on subscription restrictions valid for the mobile subscriber, whether the MS 140 is served in the new domain, i.e. whether the MS 140 is allowed to access the new domain.

25 A location update procedure can be performed not only due to physical movement of the MS 140, but, e.g., as well for the purpose of initial registration of the MS 140 in the mobile communications system 150, if the MS is switched on.

Fig. 2 shows simplified a mobile communications system comprising a HPLMN 250 and a Visited Public Land Mobile Network (VPLMN) 290. HPLMN and VPLMN can be operated by different operators. The HPLMN 250 comprises a HLR

30

260. The VPLMN 290 comprises a MSC/VLR 270 and a BSS 280. The MSC/VLR 270 is connected to the HLR 260 and the BSS 280. The VPLMN 290 serves a hybrid coverage communications service domain 200, i.e. within the domain 200 both GSM and UMTS communications services are provided. A MS 240 communicates via the BSS 280 with the mobile communications system.

Technical compatibility provided, a MS 240 that is registered by means of GSM in the mobile communications system can request a location update in order to change the access network type to UMTS, e.g. due to a trigger of an application that requires a higher bandwidth. On the other hand, a location update request is possible for the purpose of changing the registration from UMTS to GSM.

Fig. 3 shows a message flow for a HPLMN-controlled location update procedure with allowed UMTS access. A user equipment (UE) 300 sends a location update request message 330 (via a corresponding BSS or RNC, not shown) requesting UMTS or GSM access to a MSC 310 (or alternatively SGSN), which transmits a corresponding location update request message 340 to an HLR 320 that is located in the HPLMN. The HLR 320 determines, whether any subscription restrictions apply for the mobile subscriber. In the shown example, UMTS access is allowed 350. In response to the location update request 340, the HLR 320 sends an Insert Subscriber Data message 360 comprising an indication that UMTS access is allowed to the MSC 310. The MSC 310 checks the access 370 and registers the UE 300 in the requested UMTS domain, and it acknowledges the location update to the HLR 320 by sending a Insert Subscriber Data Response message 380. Furthermore, it acknowledges the performed location update by means of a Location Update Response 390 sent to the UE 300.

Fig. 4 shows a message flow for a HPLMN-controlled location update procedure for a GSM subscriber accessing a GSM network. A user equipment (UE) 300 of a GSM subscriber sends a location update request message 400 (via a corresponding BSS or RNC, not shown) requesting GSM access to a MSC 310 (or SGSN accordingly),

which transmits a corresponding location update request message 410 to an HLR 320 that is located in the HPLMN. The HLR 320 determines, whether any subscription restrictions apply for the mobile subscriber. In the shown example, UMTS access is not allowed 420. In response to the location update request 410, the HLR 320 sends an Insert Subscriber Data message 430 to the MSC 310 indicating that UMTS access is not allowed. The MSC 310 checks the access 440 and registers the UE 300 in the requested GSM domain, and it acknowledges the location update to the HLR 320 by sending a Insert Subscriber Data Response message 450. After a Location update response message 460 is received from the HLR 320, the MSC 310 acknowledges the performed location update to the UE 300 by means of a Location Update Response 470.

Fig. 5 shows a structure of an Insert Subscriber Data message 500. It comprises subscriber data 510 and a subscriber restriction parameter 520, called as well subscription restriction parameter 520. Preferably, the Insert Subscriber Data message is a MAP message. Details about MAP messages can be found in 3G TS 29.002 v. 3.7.2, 3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile Application Part (MAP) specification (release 99).

In an alternative embodiment of the invention, the SRP is requested and/or sent via separate messages each.

Fig. 6 illustrates in some examples the possible structures and values of the subscription restriction parameter SRP. Preferably, the SRP indicates an access network type restriction as shown in Fig. 6 a by the values of an 1 bit SRP parameter. If the bit value is '0', UMTS access, i.e. an access to the UMTS access network, is not allowed. If the bit value is '1', UMTS access is allowed. In another embodiment, the SRP parameter value '0' means that GSM access is not allowed, while for a value '1' GSM access is permitted.

In the case of a location update acknowledgement message, e.g. Location Update Response message 390, 470 or Insert Subscriber Data 360, 430, the 1 bit SRP can easily be understood as an acknowledgement flag in response to a dedicated location update request, e.g. with SRP='1' having the meaning 'acknowledged' and SRP='0' having the meaning 'not acknowledged'.

Furthermore, the SRP parameter can easily cover more than two different access network types, e.g. by using the appropriate number of bits.

Fig. 6 b shows a preferred embodiment of a 2 bit structure of the SRP. This structure allows for the differentiation of roaming restrictions in terms of access network types (GSM, UMTS) and network types (HPLMN, VPLMN). E.g., the SRP value '01' indicates that in the HPLMN GSM access is allowed, while the mobile subscriber is in the VPLMN entitled to UMTS access. In other words, the table indicates for HPLMN and VPLMN the allowed domains. In this way, an entry 'UMTS allowed' excludes GSM, i.e. GSM is not allowed. In a further embodiment, an entry 'UMTS allowed' includes the permission for GSM, i.e. includes 'GSM allowed'. Preferably, operators of HPLMN and VPLMN can agree in corresponding roaming agreements about such rules for interpretation of the SRP parameters.

Fig. 6 c illustrates a 4 bit structure of the SRP. The first bit represents the entitlement for UMTS in the HPLMN, the second bit the entitlement to GSM in the HPLMN. The third bit refers to UMTS in VPLMN, the fourth bit to GSM in VPLMN. Preferably, the bit value '0' means 'not allowed', while the value '1' indicates 'allowed'. By using the scheme outlined in Fig. 6 c, a mobile subscriber can be entitled to more than one access network type. In such a case, different rules can apply – e.g. dependent on operator agreements or the contract of the mobile subscriber with the HPLMN operator, or the current load situation in the corresponding network. Nevertheless, operators can set their preferences as default. E.g., if a the SRP indicates by a value '1111' an entitlement to a total roaming, the default can be 'GSM preferred'. 'UMTS preferred' or 'no default'. It should be

noted that apart from the exemplary values other possible values of the SRP not shown in the table can be valid restriction indications as well.

Fig. 6 d shows an embodiment, wherein the SRP is used to indicate multiband operation restrictions that are valid for a mobile subscriber. Multiband operations refer to roaming between domains serving different frequency areas or frequency bands, e.g. the roaming of a subscriber from GSM 900 to GSM 1800.

The SRP of Fig. 6 d has a 6 bit structure. Bit 1 refers to the frequency band 450 MHz, bit 2 refers to 800 MHz etc. Usually, the frequencies of 450 MHz to 1900 MHz refer to GSM systems, while the frequency area 2400 MHz is used for UMTS. Preferably, a bit value '1' indicates an entitlement for roaming into a communications service domain serving the given frequency area, while the value '0' indicates that a mobile subscriber is not allowed to register in such a domain.

15

Apart from the SRP value schemes as outlined in the figures 6 a to 6 d, any combinations and derivations are possible both for SRP structure and values.

Fig. 7 shows a message flow for a HPLMN-controlled location update procedure, wherein a GSM subscriber requests access to a UMTS network. The user equipment (UE) 300 sends a location update request message 730 (via a corresponding BSS or RNC, not shown) to a MSC 310 (or alternatively SGSN) requesting UMTS access. The MSC 310 transmits a corresponding location update request message 740 to the HLR 320 that is located in the HPLMN. The HLR 320 determines that there is a subscription restriction for the mobile subscriber 750, i.e. that the mobile subscriber is not entitled to UMTS access. In response to the location update request 740, the HLR 320 sends an Insert Subscriber Data message 760 indicating by means of a SRP that UMTS access is not allowed to the MSC 310. The MSC 310 checks the access 770 by evaluating the subscription restriction information received as SRP within the Insert Subscriber Data message and rejects the location update request by sending an error information indicating 'access not allowed', i.e. indicating a

20
25
30

roaming restriction as a reason for the rejection, both to the HLR 780 and the UE 790.

Fig. 8 shows a user-equipment controlled location update procedure for UMTS access. The user equipment (UE) 300 uses a UMTS SIM card (USIM) that stores the subscription restriction information valid for the mobile subscriber. The UE requests UMTS access by sending a Location Update 'USIM' request 820 to the MSC 310 (or SGSN accordingly). The location update request comprises a subscription restriction information, preferably by means of a subscription restriction parameter SRP, which is evaluated by the MSC 310 (or SGSN). Afterwards, the MSC 310 (or SGSN) performs the requested location update and acknowledges it by means of a Location Update Response message 830 to the UE 300.

Without being limited to, the invention can be used preferably in all communications systems as defined by 3GPP in the release 99 as well as in all future releases thereof. In particular, this includes UMTS networks, core networks, GSM networks and the corresponding user equipment, as well as Wireless LANs and Bluetooth TM networks and user equipments.

Claims

1. Method of performing for a mobile subscriber a location update procedure in a mobile communications system (150) having at least one first communications service domain (100; 200) and at least one second communications service domain (110, 120, 130; 200), wherein the mobile subscriber is allowed to access said first communications service domain (100; 200), and wherein a location update request (330; 400; 730; 820) is received at a network element (170; 270) of the communications system (150),
- 5
- 10 characterised in that
- a subscription restriction information (360; 430; 760; 820) is received at the network element, wherein said subscription restriction information (360; 430; 760; 820) indicates, whether a restriction for accessing the second communications service domain (110, 120, 130; 200) applies for the mobile subscriber,
- 15 the subscription restriction information (360; 430; 760; 820) is evaluated, and the location update procedure is performed depending on the evaluation.
2. Method according to claim 1, wherein a location update is performed if the evaluation of the subscription restriction information indicates that an accessing of
- 20 the second communications service domain (110, 120, 130; 200) is allowed for the mobile subscriber.
3. Method according to any preceding claim, wherein the location update request is rejected (780, 790) if the subscription restriction information evaluation indicates
- 25 that an accessing of the second communications service domain (110, 120, 130; 200) is not allowed for the mobile subscriber.
4. Method according to claim 3, wherein an error information (780, 790) is sent in response to the location update request if the request is rejected, said error
- 30 information indicating an access restriction as a reason for the rejection.

5. Method according to any preceding claim, wherein the subscription restriction information is received within the location update request (820) sent from a user equipment (140; 240; 300) of the mobile subscriber.
- 5 6. Method according to any preceding claim, wherein subscriber data information is requested from a home subscriber data register (160; 260), and wherein the subscription restriction information is received within subscriber data information (360; 430; 760) sent from the home subscriber data register (160; 260).
- 10 7. Method according to any preceding claim, wherein the subscription restriction information comprises an access network type restriction information indicating an access network type restriction.
8. Method according to any preceding claim, wherein the subscription restriction
15 information comprises a frequency band restriction information indicating a frequency band restriction.
9. Method according to any preceding claim, wherein the subscription restriction information comprises a public land mobile network type restriction information
20 indicating a public land mobile network restriction..
10. Network element (170; 270) adapted to perform the method according to any of the claims 1 to 9.
- 25 11. Home subscriber data register (160; 260) adapted to store a subscription restriction information assigned to stored data of a mobile subscriber, said subscription restriction information indicating at least one access restriction that applies to the mobile subscriber for accessing a communications service domain (100, 110, 120, 130; 200) of a mobile communications system (150).

12. Home subscriber data register (160; 260) according to claim 11, adapted to send on request a subscriber data information (360; 430; 760) comprising a subscription restriction information that applies to the mobile subscriber.
- 5 13. User equipment (140; 240; 300) of a mobile subscriber adapted to store a subscription restriction information, said subscription restriction information indicating at least one access restriction that applies to the mobile subscriber for accessing communications service domain (100, 110, 120, 130; 200) of a mobile communications system (150).
- 10 14. User equipment (140; 240; 300) according to claim 13, adapted to send a location update request comprising the subscription restriction information (820), if the user equipment (140; 240; 300) determines a change of its location area.
- 15 15. Computer program, loadable into the internal memory of a digital processing unit, comprising software code portions adapted to control the steps according to any of the claims 1 to 9, when the computer program is executed on the digital processing unit.
- 20 16. Computer program according to claim 15, wherein the computer program is stored on a computer-readable medium.

FIG. 1

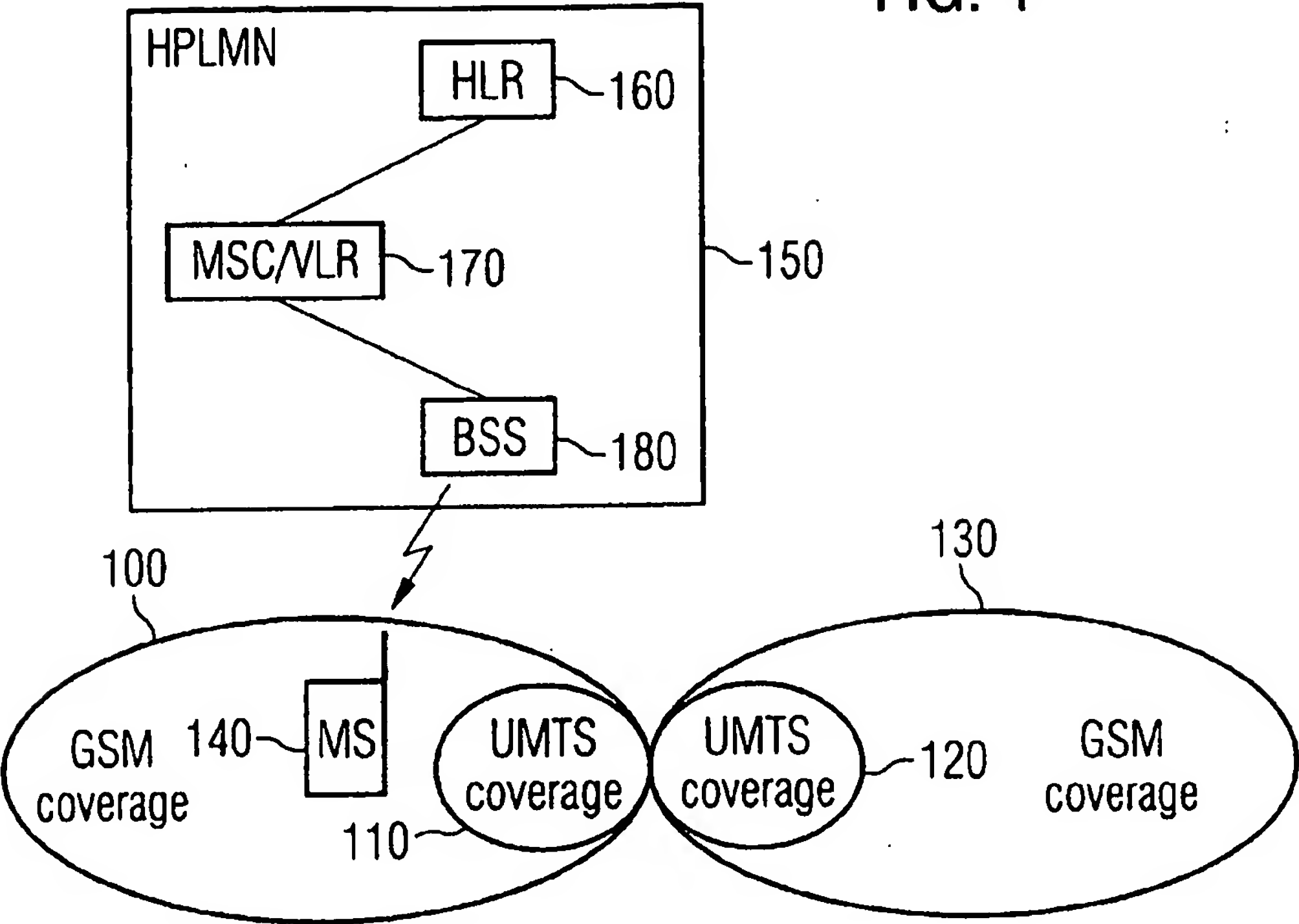
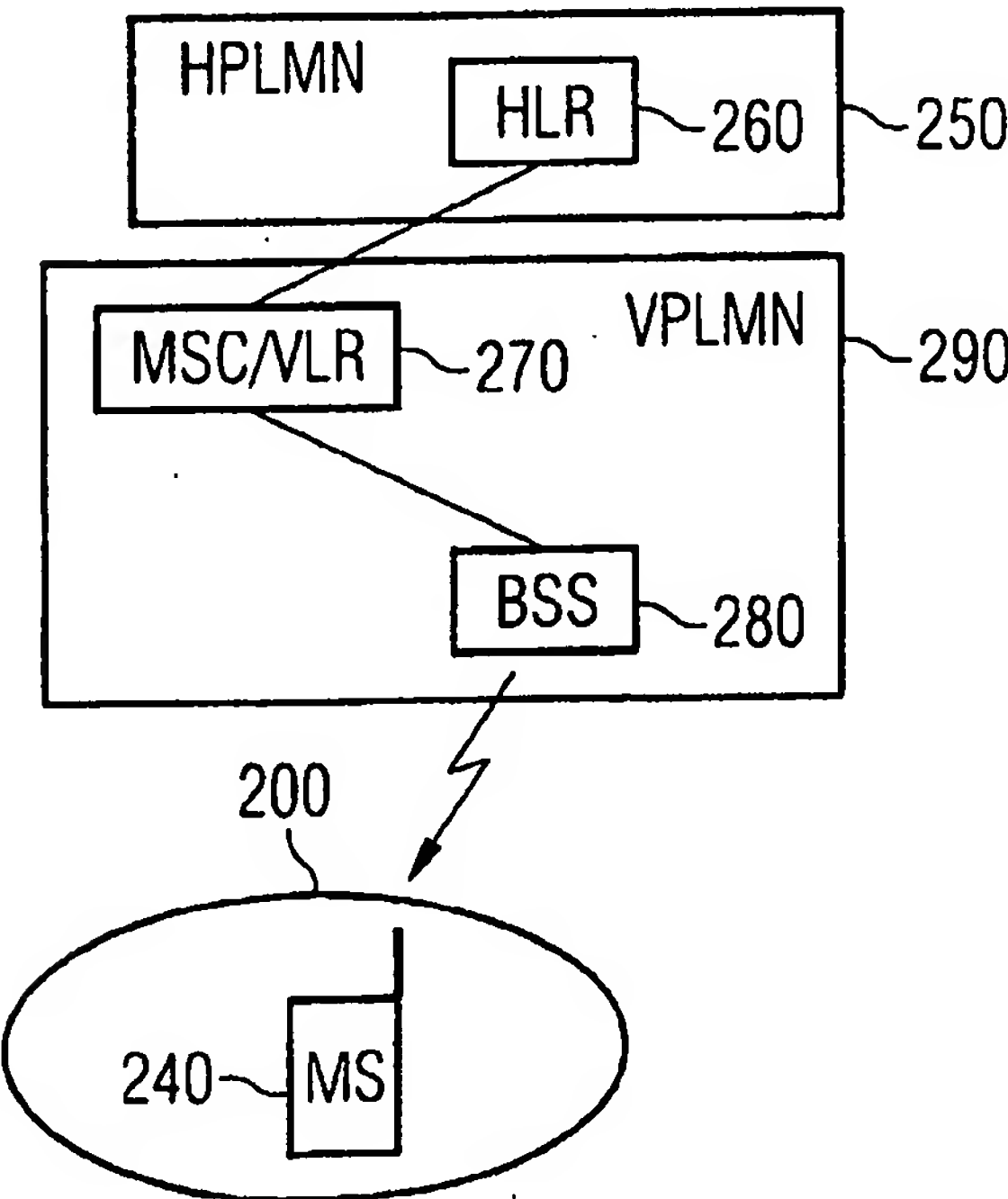


FIG. 2



2/4

FIG. 3

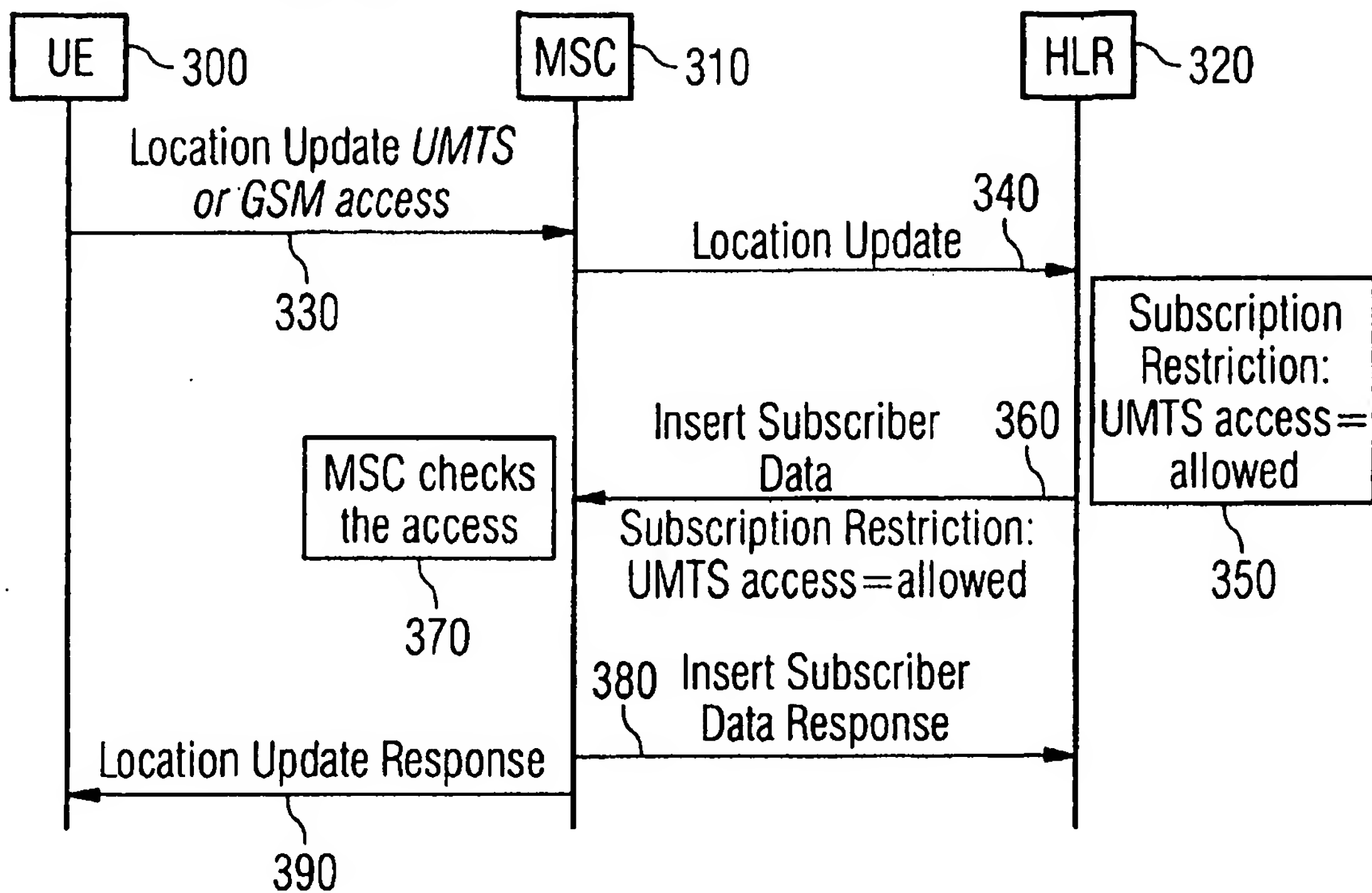
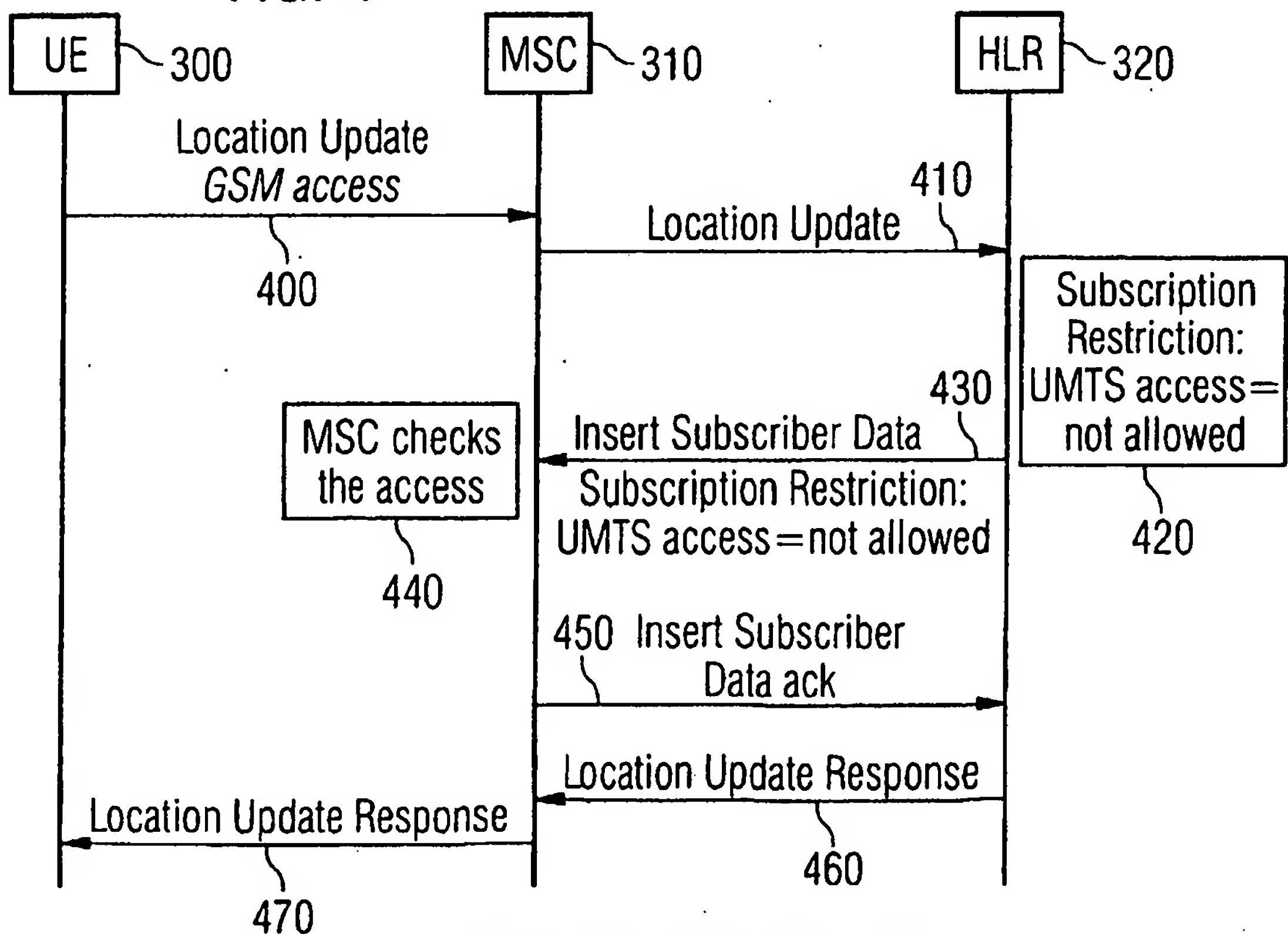


FIG. 4



3/4

FIG. 5



FIG. 6

a) 1 bit

SRP	
0	UMTS not allowed
1	UMTS allowed

or

SRP	
0	GSM not allowed
1	GSM allowed

b) 2 bit

SRP	HPLMN	VPLMN
00	GSM	GSM
01	GSM	UMTS
10	UMTS	GSM
11	UMTS	UMTS

c) 4 bit

SRP				Meaning
1st bit $\hat{=}$ UMTS in HPLMN	2nd bit $\hat{=}$ GSM in HPLMN	3rd bit $\hat{=}$ UMTS in VPLMN	4th bit $\hat{=}$ GSM in VPLMN	
0	1	0	0	GSM; only HPLMN
0	1	0	1	GSM only
0	1	1	1	GSM only and UMTS abroad
1	1	0	1	UMTS/GSM at home GSM abroad only
1	1	1	1	total roaming α) default=GSM preferred β) default=UMTS preferred γ) default=no preference
1	0	0	0	UMTS; only HPLMN
1	0	1	0	UMTS only
1	0	1	1	UMTS at home GSM/UMTS abroad

4/4

FIG. 6

6 bit

d)

		Frequency area
SRP	Bit 1	450 MHz
	Bit 2	800 MHz
	Bit 3	900 MHz
	Bit 4	1800 MHz
	Bit 5	1900 MHz
	Bit 6	2400 MHz

Bit value
'1'=allowed
'0'=rejected

FIG. 7

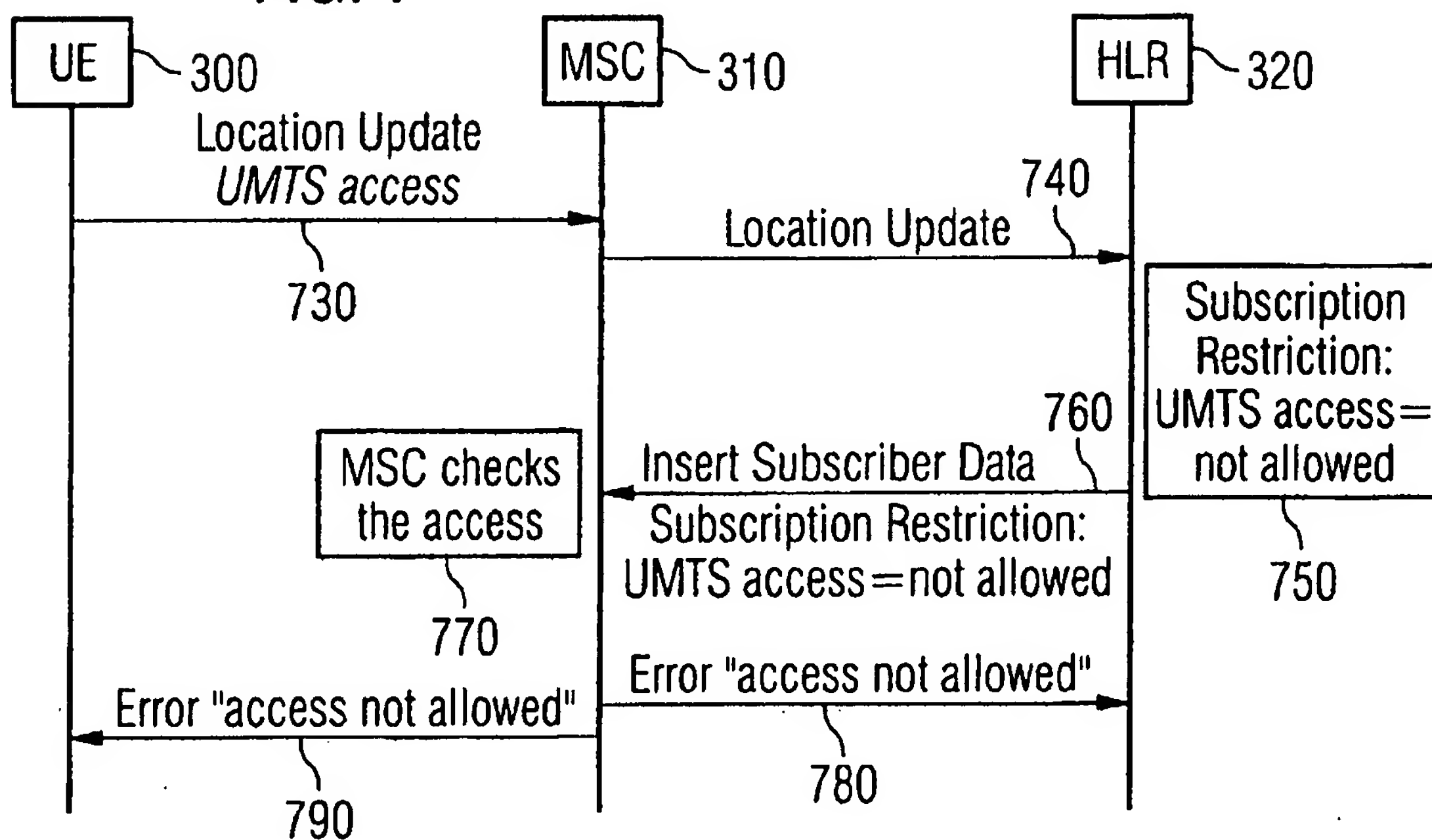
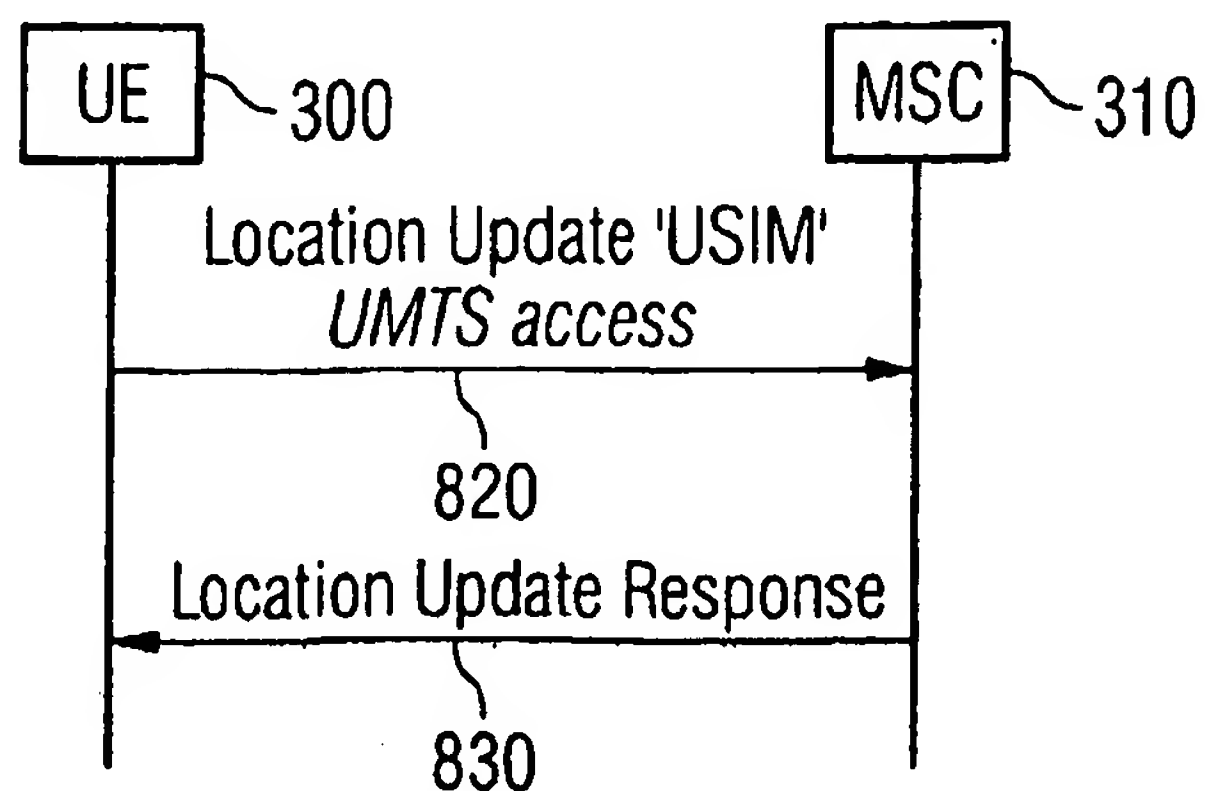


FIG. 8



INTERNATIONAL SEARCH REPORT

In - onal Application No

PCT/EP 02/01936

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 065 904 A (CIT ALCATEL) 3 January 2001 (2001-01-03) abstract column 1, line 55 -column 2, line 3 column 4, line 5 - line 15 column 6, line 51 -column 7, line 2	1-12,15, 16
Y	---	13,14
Y	WO 97 42781 A (SALM PETER V D ;ERICSSON TELEFON AB L M (SE); BLOMSTERGREN STEN ER) 13 November 1997 (1997-11-13) page 4, line 31 -page 5, line 4 page 6, line 6 - line 13 ---	13,14
	--- -/-	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the International filing date but later than the priority date claimed

T later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

16 July 2002

Date of mailing of the international search report

26/07/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 851 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Chêne, X

INTERNATIONAL SEARCH REPORT

International Application No
FI/EP 02/01936

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 059 822 A (NOKIA MOBILE PHONES LTD) 13 December 2000 (2000-12-13) abstract page 2, line 42 - line 48 page 4, line 57 -page 5, line 44 page 6, line 6 - line 19 ----	1-16
E	WO 02 25981 A (NOKIA CORP ;TUKIAINEN JYRKI (FI)) 28 March 2002 (2002-03-28) abstract page 2, line 4 - line 12 page 5, line 25 -page 6, line 3 -----	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 02/01936

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1065904	A	03-01-2001	EP 1065904 A1	03-01-2001
WO 9742781	A	13-11-1997	AU 715958 B2	10-02-2000
			AU 2893197 A	26-11-1997
			CA 2253329 A1	13-11-1997
			WO 9742781 A1	13-11-1997
			EP 0896780 A1	17-02-1999
			US 6345184 B1	05-02-2002
EP 1059822	A	13-12-2000	BR 0002069 A	02-01-2001
			CN 1276694 A	13-12-2000
			EP 1059822 A2	13-12-2000
			JP 2001016634 A	19-01-2001
WO 0225981	A	28-03-2002	WO 0225981 A1	28-03-2002